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<b>(60) Parent Application or Grant</b> VISTO CORPORATION [/]; (.) NG, Mason [/]; (.) QUINLAN, Sean, M. [/]; (.) RUAN, Tom [/]; (.) MENDEZ, Daniel, J. [/]; (.) ZHU, Jing [/]; (.) CHENG, Martin, Jr. [/]; (.) WILLIAMS, Matt, O. [/]; (.) RIGGINS, Mark, D. [/]; (.) SOCKOL, Marc, A. ; (.)			
<b>(54) Title: SYSTEM AND METHOD FOR UPDATING A REMOTE DATABASE IN A NETWORK</b> <b>(54) Titre: SYSTEME ET PROCEDE D'ACTUALISATION D'UNE BASE DE DONNEES ELOIGNEE DANS UN RESEAU</b>			
<b>(57) Abstract</b> <p>A system updates a remote server database in a network. The network comprises a global server (105) coupled to a local client (120) and a remote client (135). The local client includes a browser (175) for establishing a communications link with a web server (140) on the global server. The global server has server database memory for storing independently modifiable copies of workspace data maintained by personal information managers (PIMs) or other data stores on the local client and has PIM Downloadables (145) for interfacing with these PIMs. The local client requests synchronization capability for a particular PIM. The global server sends a PIM Downloadable corresponding to the particular PIM to the local client, which installs and initiates execution of the PIM Downloadable. Accordingly, a user interface receives information designating a database containing the workspace data to be synchronized and information selecting a synchronization mode such as one-way replace, one-way merge or two-way synchronize.</p>			
<b>(57) Abrégé</b> <p>Un système actualise une base de données éloignée de serveur dans un réseau. Le réseau comprend un serveur global (105) qui est couplé à un client local (120) et à un client éloigné (135). Le client local comprend un explorateur (175) de réseau qui établit une liaison de communication avec un serveur Web (140) sur le serveur global. Le serveur global est doté d'une mémoire de base de données de serveur qui stocke des copies pouvant être modifiées de manière indépendante de données d'espace de travail conservées par des gestionnaires personnels (GP) ou d'autres mémoires de données sur le client local et de mini-applications téléchargeables GP (145) qui assurent l'interface avec ces GP. Le client local demande une capacité de synchronisation pour un GP particulier. Le serveur global envoie au client local une mini-application téléchargeable GP correspondant au GP particulier qui installe et lance l'exécution de la mini-application téléchargeable GP. De cette manière, une interface utilisateur reçoit l'information indiquant une base de données contenant les données d'espace de travail devant être synchronisées et l'information permettant de sélectionner un mode de synchronisation tel que le mode de remplacement unilatéral, de fusion unilatérale ou de synchronisation bilatérale.</p>			

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<b>(54) Title: SYSTEM AND METHOD FOR UPDATING A REMOTE DATABASE IN A NETWORK</b>			
<b>(57) Abstract</b>			
<p>A system updates a remote server database in a network. The network comprises a global server (105) coupled to a local client (120) and a remote client (135). The local client includes a browser (175) for establishing a communications link with a web server (140) on the global server. The global server has server database memory for storing independently modifiable copies of workspace data maintained by personal information managers (PIMs) or other data stores on the local client and has PIM Downloadables (145) for interfacing with these PIMs. The local client requests synchronization capability for a particular PIM. The global server sends a PIM Downloadable corresponding to the particular PIM to the local client, which installs and initiates execution of the PIM Downloadable. Accordingly, a user interface receives information designating a database containing the workspace data to be synchronized and information selecting a synchronization mode such as one-way replace, one-way merge or two-way synchronize.</p>			
<p>The diagram illustrates a computer network architecture. At the top is a 'Global Server' box containing a 'Web Server', 'PIM Downloadables', and a 'User Data Store'. An 'Update Engine' box is connected to the 'PIM Downloadables'. A 'Local Client' box (120) contains a 'First PIM', 'First PIM Data', a 'Second PIM Client', 'Second PIM Data', and a 'Browser'. A 'Remote Client' box (135) contains a 'Browser'. The 'Global Server' is connected to the 'Local Client' via a line labeled '110' and to the 'Remote Client' via a line labeled '130'. The 'Local Client' is connected to the 'Internet' via a line labeled '115'. The 'Internet' is connected to the 'Intranet' via a dashed line labeled '130'. The 'Intranet' is connected to the 'Local Client' via a line labeled '115' and to the 'Remote Client' via a dashed line labeled '130'. The 'Local Client' is also connected to a 'Second PIM PC' box (125) via a line labeled '155'. The 'Second PIM PC' box contains a 'Second PIM Server' and 'Second PIM Data'. A line labeled '160' connects the 'Local Client' to the 'Second PIM PC'. A line labeled '165' connects the 'Second PIM Client' in the 'Local Client' to the 'Second PIM Server'. A line labeled '170' connects the 'Second PIM Data' in the 'Local Client' to the 'Second PIM Server'. A line labeled '175' connects the 'Second PIM Data' in the 'Local Client' to the 'Second PIM Data' in the 'Second PIM PC'. A line labeled '180' connects the 'Second PIM Server' in the 'Second PIM PC' to the 'Second PIM Data' in the 'Second PIM PC'. A line labeled '185' connects the 'Second PIM Data' in the 'Second PIM PC' to the 'Second PIM Data' in the 'Local Client'. The entire network is labeled '(Computer Network)' at the bottom.</p>			

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**Description**

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SYSTEM AND METHOD FOR UPDATING A REMOTE DATABASE IN A  
NETWORK

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BACKGROUND OF THE INVENTION

5 1. Field of the Invention

This invention relates generally to computer networks, and more particularly  
15 provides a system and method for updating a remote database in a computer network.

20 2. Description of the Background Art

10 Data accessibility and consistency are significant concerns for computer users. For example, when a roaming user, i.e., a user who travels to a remote location, needs to review or manipulate data such as calendar or address information, the  
25 roaming user must either carry the data to the remote location or access a workstation remotely. Maintaining a true copy of a database is a cumbersome process.  
15 Accordingly, system designers have developed an array of techniques for connecting  
30 a remote terminal across a computer network to the workstation storing the data.

35 To guarantee readability of the downloaded data, the user must carry a laptop computer containing all the applications needed to present and enable manipulation  
20 of the downloaded data, or find a network-connected computer that contains the needed application programs. Further, the user must maintain a record of all  
40 identification and authentication information for each database site that the user wishes to access.

45 Thus, a system and method are needed to enable a roaming user to access personal information stored on a remote database easily from any site connected via  
25 a network. And, to make such a system easy to use and facilitate the population of the remote database, , a system and method are needed for easily moving workspace data (such as in a PIM) from the user's local data store to the remote data store in a  
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5 manner that advantageously uses existing infrastructure such as browser technology  
and the Internet communications infrastructure.

10 SUMMARY OF THE INVENTION

5 The present invention provides a system and method for updating a remote  
15 database in a computer network. The computer network comprises a global server  
coupled to a local client and to a remote client. The local client uses a browser for  
establishing a communications link with a web server on the global server. The  
global server has memory for storing independently modifiable copies of workspace  
20 data (such as files, e-mails, calendar information, etc.) maintained by Personal  
Information Managers (PIMs) on the local client, and has PIM Downloadables for  
interfacing with these PIMs.

25 The local client requests synchronization capability for a particular PIM. The  
global server sends a PIM Downloadable corresponding to the particular PIM to the  
15 local client, which installs and initiates execution of the PIM Downloadable.  
30 Accordingly, a user interface receives information designating workspace data to be  
synchronized and information selecting a synchronization mode such as one-way  
replace, one-way merge or two-way synchronize. A PIM interface instructs the  
particular PIM to retrieve the workspace data to be synchronized. A synchronization  
35 20 module determines update data based on the synchronization mode selected and  
possibly based on an actual comparison with the corresponding workspace data copy  
on the global server. A communications engine delivers the first update data to the  
40 global server, which updates the server workspace data.

45 A claimed system comprises a user interface for receiving information  
25 designating workspace data to be synchronized and for receiving information  
selecting a synchronization mode; a PIM interface for instructing a personal  
information manager (PIM) to retrieve the workspace data to be synchronized; a  
synchronization module coupled to the user interface and the PIM interface for  
50 determining first update data based on the workspace data to be synchronized and on

5 the synchronization mode selected; and a communications engine coupled to the synchronization module for delivering the first update data to a server database.

10 Another claimed system comprises memory storing workspace data and a PIM Downloadable; a web server for establishing a communications link with a client; a 5 personal information manager (PIM) Downloadable retrieval engine coupled to the memory for receiving a request for synchronization capability from the client, and for forwarding the PIM Downloadable which includes the synchronization capability 15 to the client for installation; and a user data store manager coupled to the memory for receiving update data from the Downloadable, and for updating the workspace data 20 based on the update data received.

25 A claimed method comprises the steps of receiving information designating workspace data to be synchronized; receiving information selecting a synchronization mode; instructing a personal information manager (PIM) to retrieve 15 the workspace data to be synchronized; determining first update data based on the workspace data to be synchronized and on the synchronization mode selected; and 30 delivering the first update data to a server database.

35 Another claimed method comprises the steps of storing workspace data and a Downloadable; establishing a communications link with a client; receiving a request 20 for synchronization capability from a client; forwarding the Downloadable which includes the synchronization capability to the client for installation; receiving update data from the Downloadable; and updating the workspace data based on the update data received.

40 The system and method of the present invention may advantageously enable 45 the synchronization or one-way import of data corresponding to particular PIMs across a network to a global server. The system and method enable the selection of a mode of synchronization or import. The system and method enable the automatic configuration of both a local client and a remote client to operate this invention. That is, since the PIM Downloadable is downloaded from the global server, the local 50

5 client need only have a communications engine, such as that provided by a conventional browser, and a PIM to obtain synchronization or import capability.

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#### BRIEF DESCRIPTION OF THE DRAWINGS

5 FIG. 1 is a block diagram illustrating a computer network in accordance with the present invention;

15 FIG. 2 is a block diagram illustrating details of a computer;  
FIG. 3A is a block diagram illustrating details of the PIM downloadable of FIG. 1;

20 FIG. 3B is a block diagram illustrating details of the update engine of FIG. 1;  
FIG. 4 is a flowchart illustrating a method of updating the global server, in accordance with the present invention;

25 FIG. 5 is a flowchart illustrating the synchronization mode of one-way data replacing;

30 FIG. 6 is a flowchart illustrating the synchronization mode of one-way data merging;

35 FIG. 7 is a flowchart illustrating the synchronization mode of two-way data synchronization; and

40 FIG. 8 is a block diagram illustrating details of the user data store of FIG. 1.

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DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

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The present invention provides a system and method for updating a network database to store current PIM data, which may be accessed from any remote site coupled to the network and operating a communications engine such as a web browser.

5 FIG. 1 is a block diagram illustrating a computer network 100, in accordance with the present invention. The computer network 100 includes a global server 105 coupled via a computer network, e.g., the Wide Area Network (WAN) commonly referred to as the Internet 110, to a Local Area Network (LAN) commonly referred to 15 as an Intranet 115. A local client 120 and a calendar Personal Computer (PC) 125 are coupled to the Intranet 115. The Intranet 115, the local client 120 and the calendar PC 125 may be protected by a firewall 130. The global server 105 may be 20 protected by a global firewall (not shown). The computer network 100 further 25 includes a remote client 135 coupled to the Internet 110.

30 15 The global server 105 is a computer which includes a web server 140 for communicating with and responding to requests from web browsers. The global server 105 further includes a user data store 150 for storing user workspace data (files, calendar information, e-mails, bookmarks, etc.). FIG. 8 is a block diagram 35 illustrating details of the user data store 150. User data store 150 may include a first 40 store 805 for user#1, a second store 845 for user#2, etc. Further, each store 805, 845 45 may include separate folders for each program. For example, the first store may include a first folder 815 for calendar data, a second folder 820 for address data, a 50 third folder 825 for other PIM data, etc. Still further, each folder 815, 820, 825 may include separate workspace databases as designated by the user. For example, the 55 calendar data folder 815 may include a single calendar database 830 for a personal calendar; the address data folder 820 may include three separate databases 835 (one for business addresses, one for personal addresses, and one for miscellaneous addresses); and the other PIM data folder 825 may include three separate databases 840. It will be appreciated that, for synchronization purposes, individual records

5 may be selected from one or more PIM workspace databases and recognized as a  
single database.

10 The global server 105 also includes PIM Downloadables 145. A  
Downloadable is executable or interpretable application code, which is downloaded  
5 from a source computer and run on a destination computer. For the case herein, the  
term "executable" includes "interpretable." A Downloadable is typically requested  
15 by an ongoing process such as by an Internet browser or web client. Examples of  
Downloadables include Java<sup>TM</sup> applets designed for use in the Java<sup>TM</sup> distributing  
environment developed by Sun Microsystems, Inc., JavaScript<sup>TM</sup> scripts also  
20 developed by Sun Microsystems, Inc., ActiveX<sup>TM</sup> controls designed for use in the  
ActiveX<sup>TM</sup> distributing environment developed by the Microsoft Corporation, and  
Visual Basic also developed by the Microsoft Corporation. Downloadables may also  
25 include plugins, which add to the functionality of an already existing application  
program. It will be appreciated that each Downloadable may include one or more  
30 applets, one or more ActiveX controls, one or more plugins, etc. or combinations  
thereof. It will be further appreciated that the Downloadable need not be deleted  
upon logoff. Each PIM Downloadable 145 may communicate with a corresponding  
PIM, and may communicate with the global server 105 to update the user data store  
35 150. Details of a PIM Downloadable 145 are illustrated in FIG. 3.

40 20 The global server 105 further includes an update engine 195, which retrieves  
the appropriate PIM Downloadable and downloads it to the local client 105. The  
45 update engine 195 further responds to requests for retrieving and modifying  
workspace data contained in the user data store 150. The update engine is described  
in greater detail with reference to FIG. 3B.

50 25 The local client 120 is a computer which includes a browser 175 for  
communicating with the global server 105 via the web server 140. It will be  
appreciated that the browser 175 may include a conventional web browser. The local  
client 120 further includes a first PIM 155 and first PIM data 160. The first PIM 155  
may include an calendar program for managing calendar data, an address book

5 program for managing addresses, an e-mail program for controlling e-mails, a  
browser for controlling bookmarks, etc. Examples of the first PIM 155 include  
10 ACT! by Symantec Corporation, Lotus Organizer® standalone organizer by the  
Lotus Development Corporation, Quicken™, PeopleSoft™, sales force automation  
15 information programs, generic file managers, etc. The local client further includes a  
second PIM client 165 for communicating with a second PIM server located on  
another computer which is connected to the local client 120, and second PIM data  
170.

The second PIM PC 125 is a computer which includes a second PIM server  
20 180 for responding to the requests made by the second PIM client 165. The second  
PIM server and interface may collectively provide calendar services, address  
services, e-mail services, etc. The second PIM PC 125 includes second PIM data  
25 185 that is unique to second PIM data 170 stored on the local client 120. One skilled  
in the art will recognize that the second PIM 180 and second PIM client 165 may  
15 store second PIM data only on the local client 120, only on the second PIM PC 125,  
on both the local client 120 and the second PIM PC 125 collectively, or on both the  
30 local client 120 and the second PIM PC 125 redundantly. For example, with  
reference to e-mail servers, the second PIM PC 125 stores a copy of an e-mail  
received but downloads the copy to the local client 120 upon request by the e-mail  
35 20 server interface. Examples of the second PIM client 165 and server 180 include  
Outlook™ and Exchange™ by the Microsoft Corporation, Lotus Organizer® and  
Lotus Notes™ by the Lotus Development Corporation, GroupWise™ by Novell, Inc.,  
40 etc.

The first PIM 155 knows the location of the first PIM data 160. The second  
25 20 PIM client 165 knows the location of the second PIM data 170 on the local client  
45 120. The second PIM server 180 knows the location of the second PIM data 185  
located on the second PIM PC 125. Thus, each component can retrieve its  
corresponding data.

5        The remote client 135 includes a browser 190, which can connect to the web  
server 140 of the global server 140 and can access, review and possibly manipulate  
workspace data stored in the user data store 150.

10      FIG. 2 is a block diagram illustrating a computer system 200 which illustrates  
5        details of each of the global server 105, the local client 120, the second PIM PC 125  
and the remote client 135. The computer system 200 includes a processor 205, such  
15      as an Intel Pentium® microprocessor or a Motorola Power PC® microprocessor,  
coupled to a communications channel 220. The computer system 200 further  
includes an input device 210 such as a keyboard and mouse, an output device 215  
20      such as a Cathode Ray Tube (CRT) display, a communications device 225, data  
storage 230 such as a magnetic disk, and working memory 235 such as Random-  
Access Memory (RAM), each coupled to the communications channel 120. The  
25      communications channel 220 may be coupled to a network such as the to the Internet  
110 or to the Intranet 115. One skilled in the art will recognize that, although the  
15      data storage 230 and working memory 235 are illustrated as separate units, data  
storage 230 and working memory can be integrated or partially integrated units.

30      An operating system 240 controls processing by the processor 205, and is  
typically stored in data storage 230 and loaded into working memory 235 (as  
illustrated) for execution. Other programs such as browsers, servers, downloadables,  
35      data, etc. may also be stored in data storage 230 and loaded into working memory  
235 (as illustrated) for execution by processor 205.

40      One skilled in the art will recognize that the computer system 200 may also  
include additional information, such as network connections, additional memory,  
additional processors, LANs, input/output lines for transferring information across a  
25      hardware channel, the Internet or an Intranet, etc. One skilled in the art will also  
recognize that the programs and data may be received by and stored in the system in  
alternative ways. For example, a computer-readable storage medium (CRSM) reader  
245 such as a floppy disk drive, hard disk drive, CD-ROM reader, magneto-optical  
50      reader, CPU (for RAM), etc. may be coupled to the communications channel 220 for

5 reading a computer-readable storage medium (CRSM) 250 such as a magnetic disk, a hard disk, a magneto-optical disk, RAM, etc. Accordingly, the system 200 may receive programs and data via the CRSM reader 240.

10 FIG. 3A is a block diagram illustrating details of a PIM Downloadable 145.

5 15 Each PIM Downloadable 145 includes a user interface 305, a first PIM Application Program Interface (API) 310, a second PIM client interface 315, a communications engine 320 and a synchronization module 325.

10 The user interface 305 enables a user to designate workspace data to synchronize, enables a user to select a synchronization mode (one-way replace, one-way merge or two-way synchronize), and enables a user to initiate synchronization. Examples of the different modes of synchronization are illustrated in FIG. 5, FIG. 6 and FIG. 7, respectively. Designating workspace data to synchronize causes the web server 140 to maintain a separate database (e.g., database 830) in the user data store (e.g., user#1 store 805) corresponding to the identified user (e.g., user#1), as

15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125 130 135 140 145 150 155 160 165 170 175 180 185 190 195 200 205 210 215 220 225 230 235 240 245 250 255 260 265 270 275 280 285 290 295 300 305 310 315 320 325 330 335 340 345 350 355 360 365 370 375 380 385 390 395 400 405 410 415 420 425 430 435 440 445 450 455 460 465 470 475 480 485 490 495 500 505 510 515 520 525 530 535 540 545 550 555 560 565 570 575 580 585 590 595 600 605 610 615 620 625 630 635 640 645 650 655 660 665 670 675 680 685 690 695 700 705 710 715 720 725 730 735 740 745 750 755 760 765 770 775 780 785 790 795 800 805 810 815 820 825 830 835 840 845 850 855 860 865 870 875 880 885 890 895 900 905 910 915 920 925 930 935 940 945 950 955 960 965 970 975 980 985 990 995 1000 1005 1010 1015 1020 1025 1030 1035 1040 1045 1050 1055 1060 1065 1070 1075 1080 1085 1090 1095 1100 1105 1110 1115 1120 1125 1130 1135 1140 1145 1150 1155 1160 1165 1170 1175 1180 1185 1190 1195 1200 1205 1210 1215 1220 1225 1230 1235 1240 1245 1250 1255 1260 1265 1270 1275 1280 1285 1290 1295 1300 1305 1310 1315 1320 1325 1330 1335 1340 1345 1350 1355 1360 1365 1370 1375 1380 1385 1390 1395 1400 1405 1410 1415 1420 1425 1430 1435 1440 1445 1450 1455 1460 1465 1470 1475 1480 1485 1490 1495 1500 1505 1510 1515 1520 1525 1530 1535 1540 1545 1550 1555 1560 1565 1570 1575 1580 1585 1590 1595 1600 1605 1610 1615 1620 1625 1630 1635 1640 1645 1650 1655 1660 1665 1670 1675 1680 1685 1690 1695 1700 1705 1710 1715 1720 1725 1730 1735 1740 1745 1750 1755 1760 1765 1770 1775 1780 1785 1790 1795 1800 1805 1810 1815 1820 1825 1830 1835 1840 1845 1850 1855 1860 1865 1870 1875 1880 1885 1890 1895 1900 1905 1910 1915 1920 1925 1930 1935 1940 1945 1950 1955 1960 1965 1970 1975 1980 1985 1990 1995 2000 2005 2010 2015 2020 2025 2030 2035 2040 2045 2050 2055 2060 2065 2070 2075 2080 2085 2090 2095 2100 2105 2110 2115 2120 2125 2130 2135 2140 2145 2150 2155 2160 2165 2170 2175 2180 2185 2190 2195 2200 2205 2210 2215 2220 2225 2230 2235 2240 2245 2250 2255 2260 2265 2270 2275 2280 2285 2290 2295 2300 2305 2310 2315 2320 2325 2330 2335 2340 2345 2350 2355 2360 2365 2370 2375 2380 2385 2390 2395 2400 2405 2410 2415 2420 2425 2430 2435 2440 2445 2450 2455 2460 2465 2470 2475 2480 2485 2490 2495 2500 2505 2510 2515 2520 2525 2530 2535 2540 2545 2550 2555 2560 2565 2570 2575 2580 2585 2590 2595 2600 2605 2610 2615 2620 2625 2630 2635 2640 2645 2650 2655 2660 2665 2670 2675 2680 2685 2690 2695 2700 2705 2710 2715 2720 2725 2730 2735 2740 2745 2750 2755 2760 2765 2770 2775 2780 2785 2790 2795 2800 2805 2810 2815 2820 2825 2830 2835 2840 2845 2850 2855 2860 2865 2870 2875 2880 2885 2890 2895 2900 2905 2910 2915 2920 2925 2930 2935 2940 2945 2950 2955 2960 2965 2970 2975 2980 2985 2990 2995 3000 3005 3010 3015 3020 3025 3030 3035 3040 3045 3050 3055 3060 3065 3070 3075 3080 3085 3090 3095 3100 3105 3110 3115 3120 3125 3130 3135 3140 3145 3150 3155 3160 3165 3170 3175 3180 3185 3190 3195 3200 3205 3210 3215 3220 3225 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5 the second PIM client interface 315 requests the second PIM client 165 to retrieve  
the appropriate databases of the second PIM data 170 and of the second PIM data  
185. The second PIM client 165 responsively retrieves the appropriate workspace  
data from second PIM data 170 and requests the second PIM server 180 to retrieve  
10 5 the appropriate workspace data from second PIM data 185. The second PIM client  
165 passes the workspace data from the second PIM data 170 and from the second  
PIM data 185 to the PIM Downloadable 145. Alternatively, the second PIM client  
15 165 may inform the PIM Downloadable 145 of the locations of the databases on the  
second PIM data 170 and on the second PIM data 185. As another alternative, the  
second PIM client 165 may retrieve the appropriate workspace data from the second  
20 10 PIM data 185 on the second PIM PC 125, and store them locally with the second  
PIM data 170. The second PIM client 165 may then inform the PIM Downloadable  
145 of the locations of the appropriate databases. It will be appreciated that other  
25 15 methods of enabling the PIM Downloadable 145 to access the workspace data are  
also possible. It will be appreciated that the second PIM client interface 315 may be  
included in a separate PIM Downloadable 145, which has second instances of the  
30 30 user interface 305, the communications engine 320 and the synchronization module  
325.

35 The communications engine 320 includes program code for enabling the PIM  
20 20 Downloadable 145 to communicate with the web server 140, optionally via the  
browser 175.

40 Upon request, the synchronization module 325 instructs the first PIM interface  
310 or the second PIM client interface 315 to perform its services for retrieving the  
45 25 workspace data to be synchronized. The synchronization module 325 also requests  
the web server 140 to retrieve the workspace data from the user data store 150 on the  
global server 105, and to pass the information via the Internet to the local client 120.  
Alternatively, if a previously status of the database stored on the global server 105 is  
50 45 known, then the synchronization module 325 may request only the changes made  
since then. In any case, the synchronization module 325 need only learn the content

5 of the corresponding database stored in the user data store 250 on the global server  
105. The synchronization module 325 compares the data contained in the local client  
120 database with the data contained in the corresponding global server 105  
database, and accordingly performs a synchronizing response. The three modes of  
10 5 synchronization, i.e., one-way merge, one-way replace and two-way synchronization,  
are illustrated and described below with reference to FIGs. 5, 6 and 7. It will be  
appreciated that the synchronization module 325 need not learn the contents  
15 contained in the corresponding database stored in the user data store 150 on the  
global server 105 when performing a one-way replace operation (since the contents  
10 20 are overwritten and thus irrelevant).

20 FIG. 3B is a block diagram illustrating details of the update engine 195. The  
update engine includes a communications engine 350, a PIM Downloadable retrieval  
25 engine 355 and a user data store manager 360. The communications engine 350  
communicates with the communications engine 320 of the PIM Downloadable 145.

15 15 The PIM Downloadable retrieval engine 355 receives requests for synchronization  
capability from the local client 120. Each request may identify the particular PIM or  
30 alternatively may identify the service such as address book, calendar or e-mail for  
which synchronization is desired. If only the service is identified, the PIM  
Downloadable retrieval engine 355 determines the PIM based on a previous selection  
35 20 corresponding to the service identified. The user data store manager 360 controls  
retrieval and manipulation of workspace data contained in the user data store 150.  
That is, the user data store manager 360 retrieves workspace data for the server  
40 45 database identified by the PIM Downloadable 145 as the database to be  
synchronized. The user data store manager 360 forwards the corresponding  
25 workspace data to the PIM Downloadable 145 for comparison with the database  
maintained by the PIM. The user data store manager 360 also modifies the server  
database based on update data received from the PIM Downloadable 145.

50 FIG. 4 is a flowchart illustrating a method 400 of synchronizing PIM data  
with a global server 105, in accordance with the present invention. Method 400

5 starts with the local client 120 in step 405 requesting a connection to the global  
server 105 using the browser 175 and common URL technology. The browser 175  
and web server 140 in step 410 establish a communications link. The web server 140  
in step 415 sends HTML data to the browser 175 for setting up a user interface,  
10 5 which may include a request for user identification and authentication information.  
The browser 175 in step 420 sends the user identification and authentication  
information to the web server 140, which identifies and authenticates the user.  
15

10 The local client 120 in step 425 requests synchronization capabilities for a  
particular PIM, such as for the first PIM 155. The PIM Downloadable retrieval  
15 engine 355 in step 430 downloads a PIM Downloadable 145 corresponding to the  
particular PIM to the local client 105 via the browser 175, if necessary. That is, if the  
20 downloadable 145 has already been downloaded or stored on the local client 105,  
then the step 430 is unnecessary. The browser 175 in step 435 installs the PIM  
25 Downloadable 145. Installing the downloadable 145 may include moving the  
30 downloadable to working memory for execution. The local client 105 in step 440  
requests synchronization of a particular PIM database. The local client 120 in step  
35 443 configures the PIM Downloadable 145 by selecting one of three available modes  
40 of synchronization, described in detail with reference to FIGs. 5-7, although other  
modes are possible. The browser 175 in step 445 initiates execution of the PIM  
45 Downloadable 145. The PIM interface corresponding to the PIM maintaining the  
database (e.g., the first PIM interface 310) in step 450 requests the PIM (e.g., the first  
50 PIM 155) to retrieve the PIM workspace data (e.g., the PIM data 160 contained  
within the PIM database). The PIM Downloadable 145 in step 455 performs  
synchronization with the global server 105 according to the synchronization mode  
selected above in step 440. Method 400 then ends.

45 FIG. 5 is a flowchart illustrating a method 500 of replacing data, referred to  
herein as a "replacement synchronization mode." Method 500 illustrates a first  
example for performing step 455. Method 500 begins with the synchronization  
50 module 325 in step 505 receiving the PIM data for the selected database from the

5 PIM, e.g., the first PIM 155. The synchronization module 325 in step 510 uses the  
communications module to forward the PIM data to the web server 140. The user  
data store manager 360 in step 515 replaces the workspace data of the selected  
database in the user data store 150 with the forwarded workspace data. Method 500  
10 then ends.

15 For example, if the database maintained by the PIM contains exactly records  
A, B and D, then regardless of the contents of the database on the global server 105  
the synchronization module 325 will upload elements A, B and D to the global server  
105. The user data store manager 360 will replace the workspace data on the global  
20 server 105 with the uploaded workspace data. Accordingly, both the database  
maintained by the global server 105 and the database maintained by the PIM will  
store exactly records A, B and D.

25 FIG. 6 is a flowchart illustrating a method 600 of merging data, referred to  
herein as a “merging synchronization mode.” Method 600 illustrates a second  
30 example for performing step 455. Method 600 begins with the synchronization  
module 325 in step 605 receiving the PIM data for the selected database from the  
PIM, e.g., the first PIM 155. The synchronization module 325 in step 610 learns the  
contents of the corresponding database on the global server 105. Learning the  
35 contents of the database on the global server 105 may include downloading the entire  
contents of the database, or using software cache technology to download the  
differences from the last download. The synchronization module 325 in step 615  
compares the database contents to determine update data indicating how the database  
40 maintained by the PIM was modified (updated) relative to the database maintained  
on the global server 105. For example, records may have been deleted, added or  
modified since the last connection, documents may have been modified since the last  
45 connection, etc. The synchronization module 325 in step 620 instructs the  
communications module to send the update data to the global server 105. The user  
data store manager 360 in step 625 adds (manipulates, etc.) the update data to the  
50 database in the user data store 150. Method 600 then ends.

5 For example, the database maintained by the PIM may include records A, B  
and D and the database maintained by the global server 105 may include records A,  
10 B and C. The synchronization module 325 compares the contents of the databases to  
learn that the database maintained by the global server 105 does not include record  
15 D. Thus, the synchronization module 325 forwards record D to the global server  
105, which stores the record in the corresponding database. Accordingly, the  
database maintained by the global server 105 will contain records A, B, C and D, and  
the database maintained by the PIM will contain records A, B and D.

For another example, the database maintained by the PIM may have included  
20 records A, B, C and D and the database on the global server may include records A,  
B, C and D. If record C is deleted, the synchronization module 325 will determine  
based on version information that the record C has been deleted. Accordingly, the  
25 synchronization module 325 may do nothing so that a superset is maintained on the  
global server 105. Thus, the database on the global server 105 will contain records  
15 A, B, C and D, and the database maintained by the PIM will contain records A, B  
and D. Alternatively, the synchronization module 325 may inform the web server  
30 140 that record C has been deleted, and the user data store manager 360 may delete  
record C from the corresponding database on the global server 105. In this case, the  
database maintained by the global server 105 and the database maintained by the  
35 PIM will each contain records A, B and D.

FIG. 7 is a flowchart illustrating a method 700 of performing two-way  
40 synchronization, referred to herein as "two-way synchronization mode." Method 700  
begins with the synchronization module 325 in step 705 receiving the PIM data for  
the selected database from the PIM, e.g., the first PIM 155. The synchronization  
45 module 325 in step 710 learns the contents of the corresponding database on the  
global server 105. The synchronization module 325 in step 715 compares the  
workspace data from the database to determine update data indicating how the  
database maintained by the PIM was updated relative to the database maintained on  
50 the global server 105 and update data indicating how the database on the global

5 server was updated relative to the database maintained by the PIM. As stated above, workspace data in the database maintained by the PIM may have been deleted, added or modified. The synchronization module 325 in step 720 sends the update data to the global server 105. The user data store manager 360 in step 725 adds the update  
10 5 data to the database in the user data store 150. The PIM interface, e.g., the first PIM interface 310, in step 730 instructs the PIM, e.g., the first PIM 155, to add its update information to PIM data 160 in the appropriate database. The PIM in step 735 adds  
15 15 the update data to the database. Method 700 then ends.

For example, the database maintained by the PIM may include records A, B  
20 10 and D and the database on the global server 105 may include records A, B and C. The synchronization module 325 will compare the workspace data to learn that the database maintained by the PIM does not include record C and that the database on the global server 105 does not include the record D. Accordingly, the  
25 25 synchronization module 325 will send record D to the global server 105 and the PIM  
15 15 interface will instruct the PIM to store record C in the appropriate database.

The foregoing description of the preferred embodiments of the present  
30 30 invention is by way of example only, and other variations and modifications of the above-described embodiments and methods are possible in light of the foregoing teaching. For example, although the invention has been described with reference to  
35 35 browsers, any web engine for communicating with a web server may alternatively be used. Although the system has been described as having only two PIMs (and thus only two PIM interfaces, only two PIM downloadables, etc.), one skilled in the art will recognize that any number of PIMs may be managed by the system and methods of the present invention. Although the workspace data has been defined mostly in  
40 40 terms of email, calendar, bookmarks, etc, one skilled in the art will recognize that workspace data may include other types of data such as files, financial transactions, etc. Although the PIM Downloadable has been described as including a PIM  
45 45 interface to communicate with a PIM to obtain data to be synchronized, one skilled in the art will recognize that, if the Downloadable knows the location of the data, no  
50 50

5 PIM interface is needed. Thus, the downloadable may use an engine for retrieving  
the data from the known location without the assistance of a PIM. Although the  
10 network sites are being described as separate and distinct sites, one skilled in the art  
will recognize that these sites may be a part of an integral site, may each include  
15 portions of multiple sites, or may include combinations of single and multiple sites.  
Although each of the network sites is being described as a single computer, one  
skilled in the art will recognize that each site may include multiple computers.  
20 Further, components of this invention may be implemented using a programmed  
general purpose digital computer, using application specific integrated circuits, or  
25 using a network of interconnected conventional components and circuits.  
Connections may be wired, wireless, modem, etc. The embodiments described  
herein are not intended to be exhaustive or limiting. The present invention is limited  
only by the following claims.

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**Claims**

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(b)(5)

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WHAT IS CLAIMED IS:

1. A computer-based method, comprising the steps of:

using a browser to receive identification of a downloadable from a computer

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network;

5 initiating execution of the downloadable;

receiving information designating workspace data to be synchronized and

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designating a synchronization mode;

using the Downloadable to instruct a personal information manager (PIM) to retrieve the workspace data to be synchronized;

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10 using the Downloadable to determine first update data based on the workspace data to be synchronized and on the synchronization mode; and

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using the Downloadable to deliver the first update data to a server database connected to the computer network.

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15 2. The method of claim 1, wherein the synchronization mode is one of one-way replace, one-way merge and two-way synchronization.

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3. The method of claim 1, further comprising the steps of communicating with the server database to learn the server database contents associated with the 20 workspace data to be synchronized, and comparing the server database contents and the workspace data to be synchronized.

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4. The method of claim 3, wherein the step of determining first update data is 45 based on the comparison.

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5        5.     The method of claim 4, further comprising the steps of determining second update data based on the comparison, and instructing the PIM to modify the workspace data to be synchronized by the second update data.

10        5     6.     The method of claim 1, further comprising the step of downloading the downloadable from the server database.

15        7.     **A system, comprising:**

20        means for using a browser to receive identification of a downloadable from a computer network;

25        means for initiating execution of the downloadable;

30        means for receiving information designating workspace data to be synchronized and designating a synchronization mode;

35        means for using the Downloadable to instruct a personal information manager (PIM) to retrieve the workspace data to be synchronized;

40        means for using the Downloadable to determine first update data based on the workspace data to be synchronized and on the synchronization mode; and

45        means for using the Downloadable to deliver the first update data to a server database connected to the computer network.

50        8.     **A computer-readable storage medium storing program code for causing a computer to perform the steps of:**

55        using a browser to receive identification of a downloadable from a computer network;

60        initiating execution of the downloadable;

65        receiving information designating workspace data to be synchronized and designating a synchronization mode;

5 using the Downloadable to instruct a personal information manager (PIM) to  
retrieve the workspace data to be synchronized;

10 10 using the Downloadable to determine first update data based on the workspace  
data to be synchronized and on the synchronization mode; and

15 5 using the Downloadable to deliver the first update data to a server database  
connected to the computer network.

20 9. A system, comprising:  
a downloadable including

25 10 a user interface for receiving information designating workspace data  
to be synchronized and designating a synchronization mode;

30 25 a PIM interface for instructing a personal information manager (PIM)  
to retrieve the workspace data to be synchronized;

35 15 a synchronization module coupled to the user interface and the PIM  
interface for determining first update data based on the workspace data to be  
synchronized and on the synchronization mode; and

40 20 a communications engine coupled to the synchronization module for  
delivering the first update data to a server database; and

45 35 a browser for receiving identification of the downloadable from a computer  
network, and for initiating execution of the downloadable.

50 10. The system of claim 9, wherein the synchronization mode is one of one-way  
replace, one-way merge and two-way synchronization.

45 25 11. The system of claim 9, wherein the synchronization module learns the server  
database contents corresponding to the workspace data to be synchronized, and  
compares the server database contents and the workspace data to be synchronized.

5

12. The system of claim 11, wherein the synchronization module determines the first update data based on the comparison.

10

5 13. The system of claim 12, wherein the synchronization module determines second update data based on the comparison, and instructs the PIM to modify the  
15 workspace data to be synchronized by the second update data.

20

14. The system of claim 9, wherein the Downloadable is downloaded from the  
10 server database.

25

15. Program code embodied in a carrier wave for controlling a computer to perform the steps of:

30 15 receiving information designating workspace data to be synchronized and a synchronization mode;

35 15 instructing a personal information manager (PIM) to retrieve the workspace data to be synchronized;

40 35 determining first update data based on the workspace data to be synchronized and on the synchronization mode; and

45 20 delivering the first update data to a server database.

40

16. A computer-based method, comprising the steps of:

45 25 storing workspace data and a Downloadable;

50 30 establishing a communications link with a client;

35 35 receiving a request for synchronization capability from a client;

40 40 forwarding the Downloadable which includes the synchronization capability to the client for installation;

5 receiving update data from the Downloadable; and  
5 updating the workspace data based on the update data received.

10 17. The method of claim 16, wherein the method is performed by a server coupled  
5 via a network to the client.

15 18. The method of claim 16, wherein the workspace data is contained in a user  
data store.

20 19. The method of claim 16, wherein the step of establishing a communications  
link with a client includes using URL technology.

25 20. The method of claim 16, wherein the request for synchronization capability  
includes information identifying a particular PIM for which synchronization is  
15 desired.

30 35 21. The method of claim 20, wherein the information includes identification of a  
service, and wherein the particular PIM corresponding to the service is known.

40 20 22. The method of claim 21, further comprising the step of retrieving a  
Downloadable corresponding to the particular PIM.

45 23. The method of claim 22, wherein the Downloadable retrieved includes an  
interface to the particular PIM.

50

5 24. The method of claim 16, wherein the Downloadable includes a user interface  
for enabling a user to select a synchronization mode and to designate a database  
containing workspace data to be synchronized.

10 5 25. The method of claim 16, wherein the Downloadable includes a synchronization  
module for computing the update data.

15 26. The method of claim 25, wherein the synchronization module computes the  
update data based on one of one-way replace, one-way merge and two-way  
20 synchronization.

25 27. A system, comprising:  
means storing workspace data and a Downloadable;  
means for establishing a communications link with a client;  
30 15 means for receiving a request for synchronization capability from the client;  
means for forwarding a Downloadable which includes the synchronization  
capability to the client for installation;  
means for receiving update data from the Downloadable; and  
35 means for updating the workspace data based on the update data received.

20 40 28. A system, comprising:  
memory storing workspace data and a PIM Downloadable;  
a web server for establishing a communications link with a client;  
45 45 a personal information manager (PIM) Downloadable retrieval engine coupled  
25 to the memory for receiving a request for synchronization capability from the client,  
and for forwarding the PIM Downloadable which includes the synchronization  
50 capability to the client for installation; and

5 a user data store manager coupled to the memory for receiving update data from the Downloadable, and for updating the workspace data based on the update data received.

10 5 29. The system of claim 28, wherein the workspace data is contained in a user data store.

15 15 30. The system of claim 28, wherein the web server establishes a communications link with a client using URL technology.

20 25 10 31. The system of claim 28, wherein the request for synchronization capability includes information identifying a particular PIM for which synchronization is desired.

30 30 15 32. The system of claim 31, wherein the information includes identification of a service, and wherein the particular PIM corresponding to the service is known.

35 35 33. The system of claim 32, wherein the memory stores a plurality of PIM Downloadables and wherein the PIM Downloadable retrieval engine retrieves a 20 Downloadable corresponding to the particular PIM.

40 40 34. The system of claim 33, wherein the PIM Downloadable retrieved includes an interface to the particular PIM.

45 50 25 35. The system of claim 28, wherein the PIM Downloadable includes a user interface for enabling a user to select a synchronization mode and to designate a database containing the workspace data to be synchronized.

5

36. The system of claim 28, wherein the Downloadable includes a synchronization module for computing the update data.

10

5 37. The system of claim 36, wherein the synchronization module computes the update data based on one of one-way replace, one-way merge and two-way synchronization.

15

20 38. A computer-based method, comprising the steps of:

10 establishing a communications link with a server storing workspace data; receiving identification of a PIM Downloadable; 25 executing the PIM Downloadable to instruct a personal information manager (PIM) to retrieve PIM data; and executing the PIM Downloadable to update the workspace data stored on the 30 server based on the retrieved PIM data.

30

35 39. The method of claim 38, further comprising the step of requesting synchronization capability for a particular PIM.

35

20 40. The method of claim 39, further comprising the steps of receiving and 40 installing the PIM Downloadable from the server.

45

41. The method of claim 38, wherein the PIM Downloadable has already been installed.

25

50

55

5        42.    The method of claim 39, wherein the step of requesting synchronization capability includes information identifying a particular PIM for which synchronization is desired.

10      5        43.    The method of claim 42, wherein the information includes identification of a service, and wherein the particular PIM corresponding to the service is known.

15      15      44.    The method of claim 38, wherein the PIM Downloadable includes an interface to the PIM.

20      10      45.    The method of claim 38, wherein the PIM Downloadable includes a user interface for enabling a user to select a synchronization mode and to designate a 25      25      database containing the workspace data to be synchronized.

30      15      46.    The method of claim 38, wherein the Downloadable includes a synchronization module for computing the update data.

35      35      47.    The method of claim 46, wherein the synchronization module computes the update data based on one of one-way replace, one-way merge and two-way 20      20      synchronization.

40      48.    A system, comprising:  
45      an installed PIM interface downloadable associated with the identification for instructing a PIM to retrieve PIM data;  
50      25      an installed synchronization module downloadable coupled to the PIM interface for determining update data based on the PIM data retrieved, and for forwarding the update data to the server to update the workspace data; and

5 a browser for establishing a communications link with a server storing  
10 workspace data, for receiving identification of the PIM interface downloadable and  
15 the synchronization module downloadable, and for initiating execution of the  
20 downloadables.

10 downloadables.

49. A method, comprising the steps of:

15 using a browser to receive identification of a downloadable from a computer network;

initiating execution of the downloadable;

20 10 receiving information designating workspace data to be synchronized  
and designating a synchronization mode;

using the Downloadable to retrieve the workspace data to be synchronized;

using the Downloadable to determine first update data based on the

<sup>15</sup> workspace data to be synchronized and on the synchronization mode; and

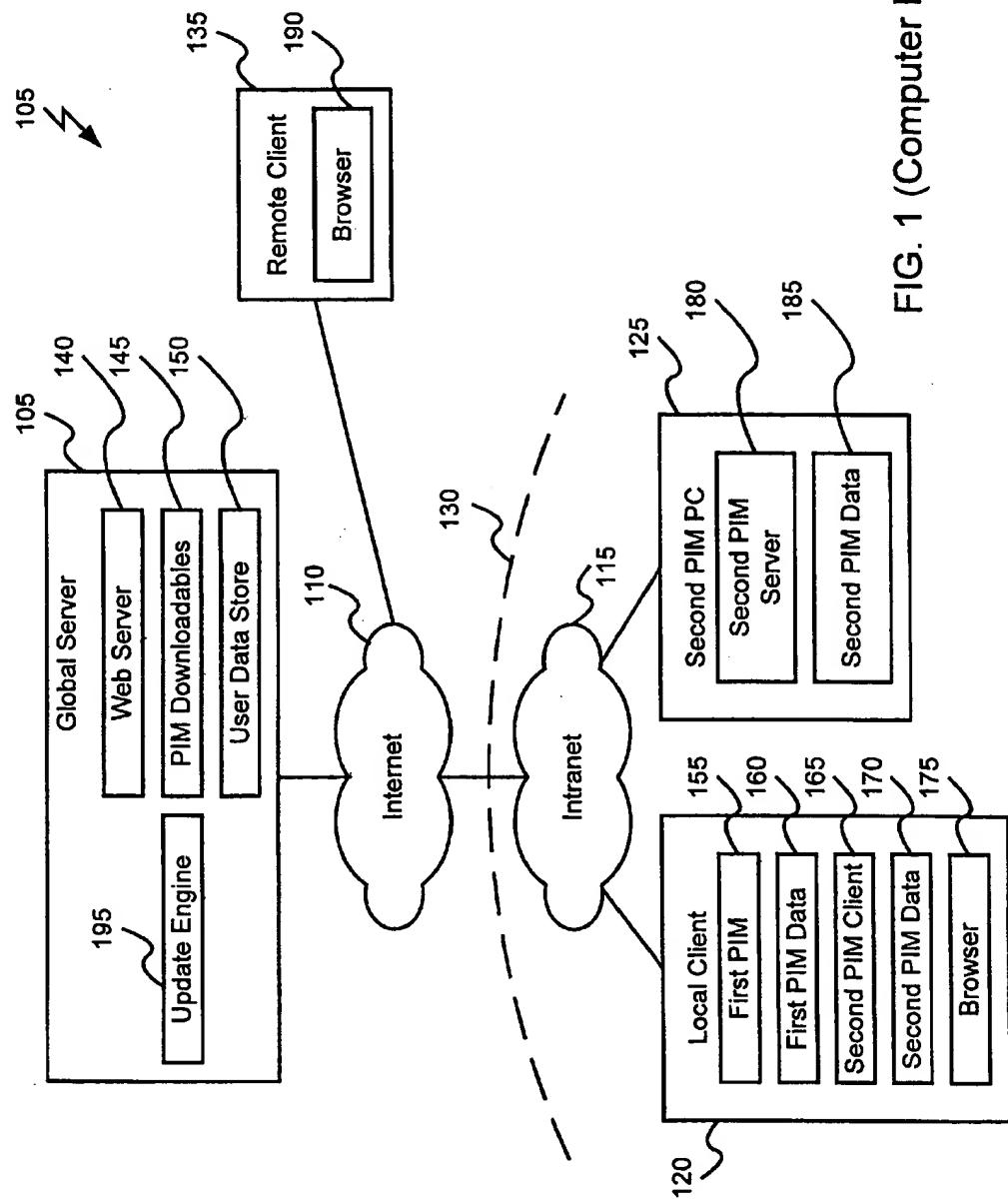
using the Downloadable to deliver the first update data to a server database connected to the computer network

35

40

45

50



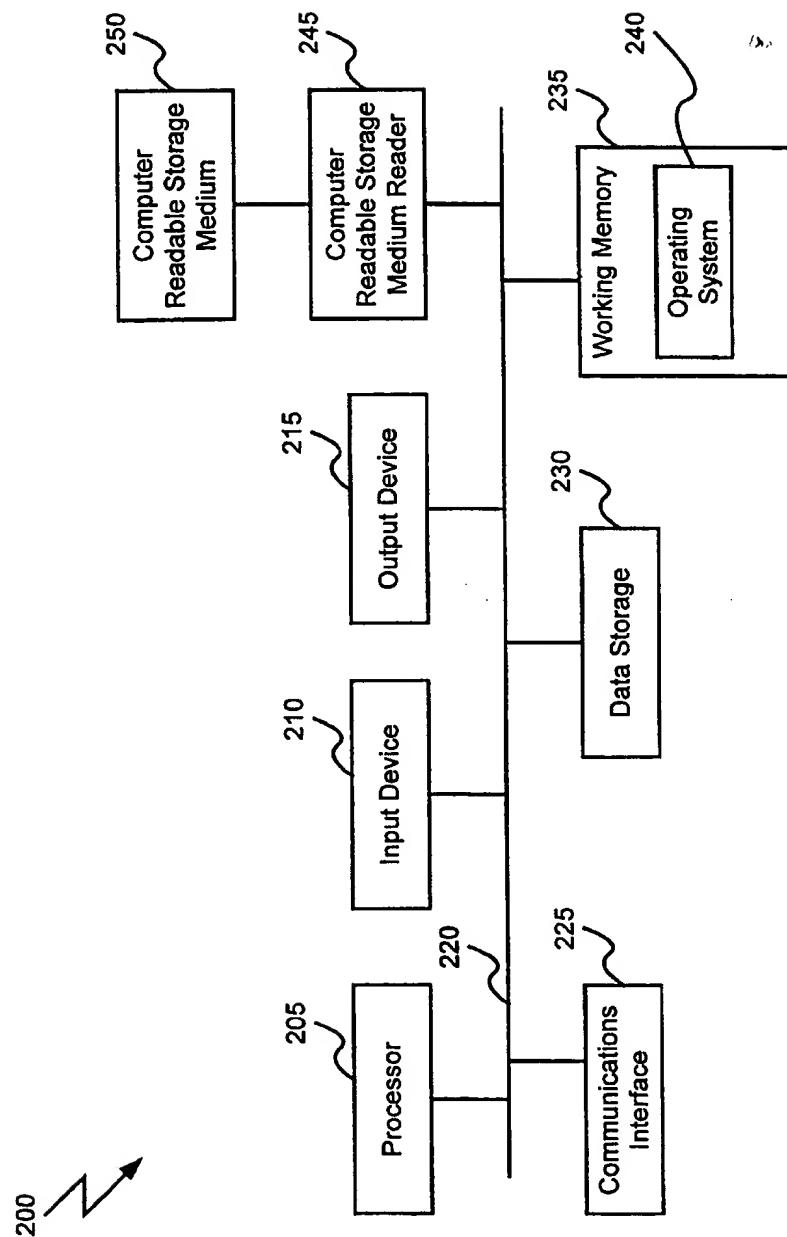
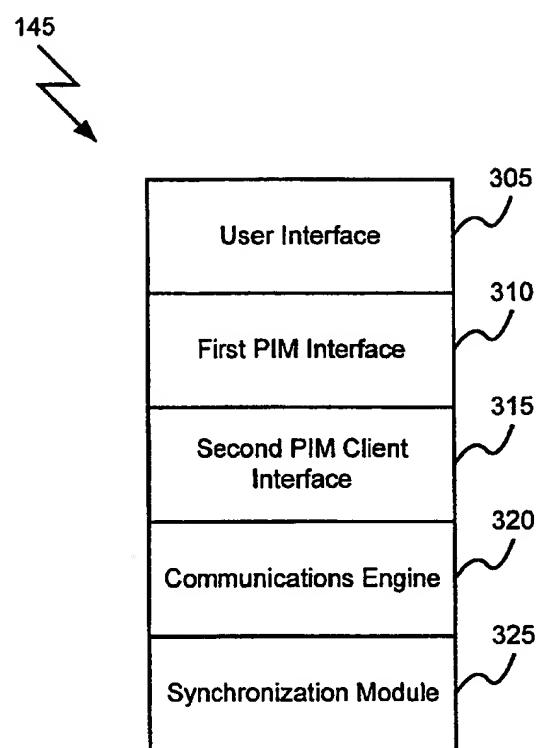


FIG. 2



**FIG. 3A**  
**(PIM**  
**Downloadable)**

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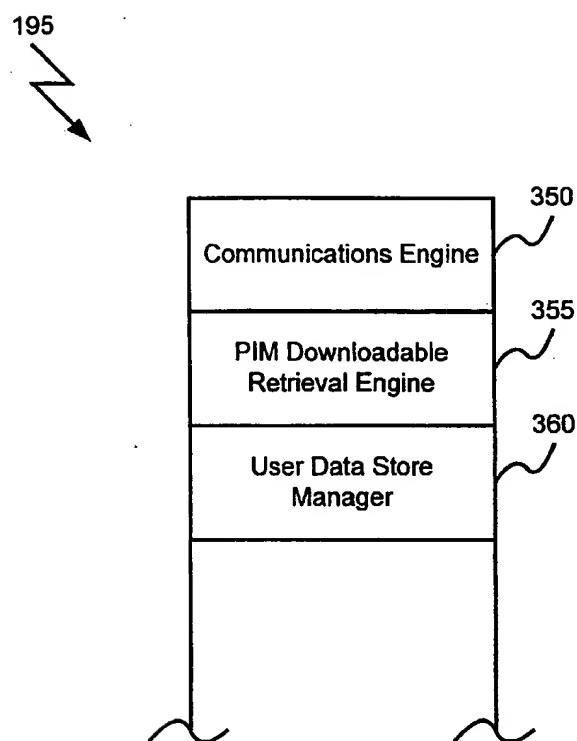


FIG. 3B

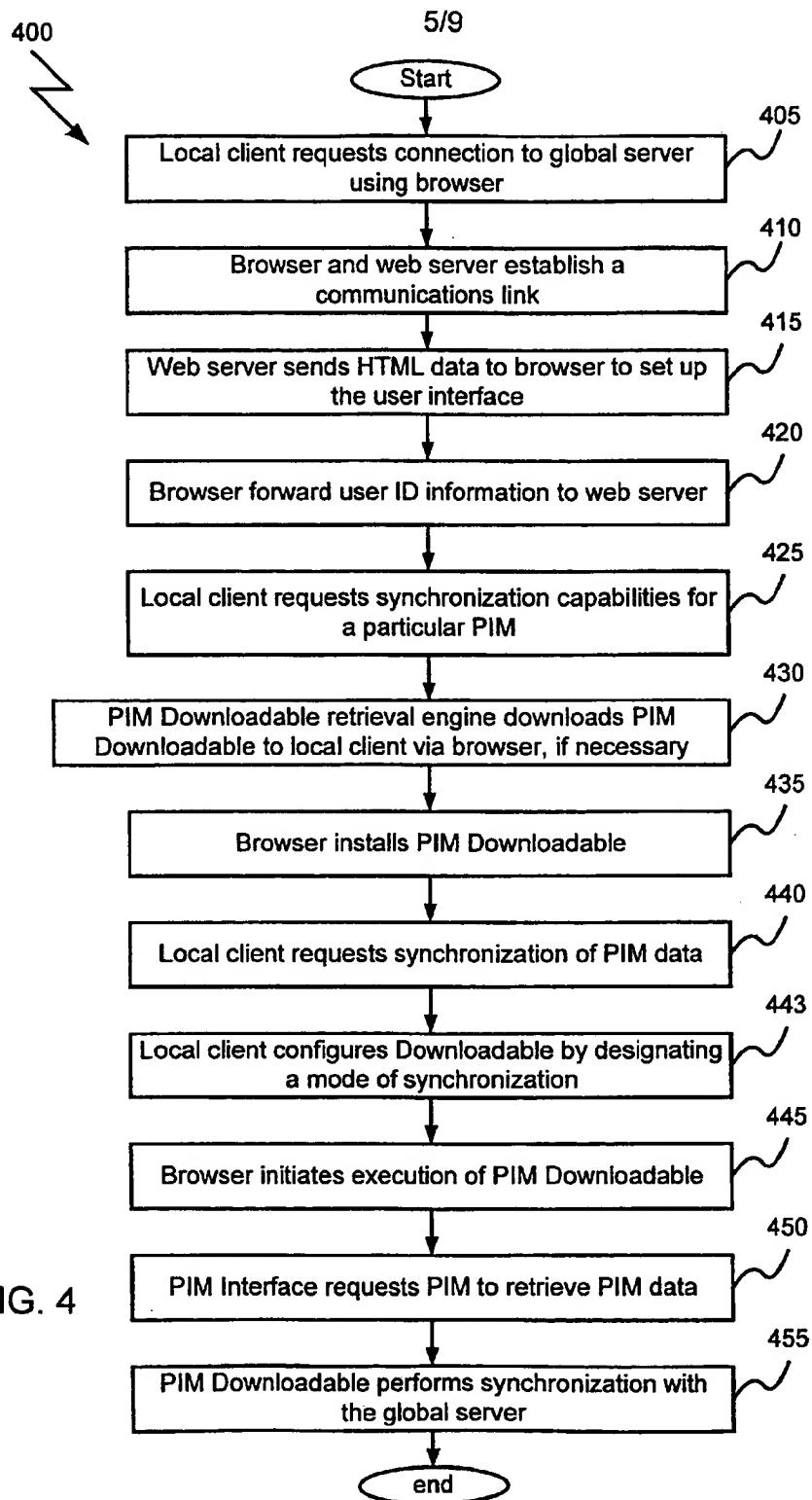


FIG. 4

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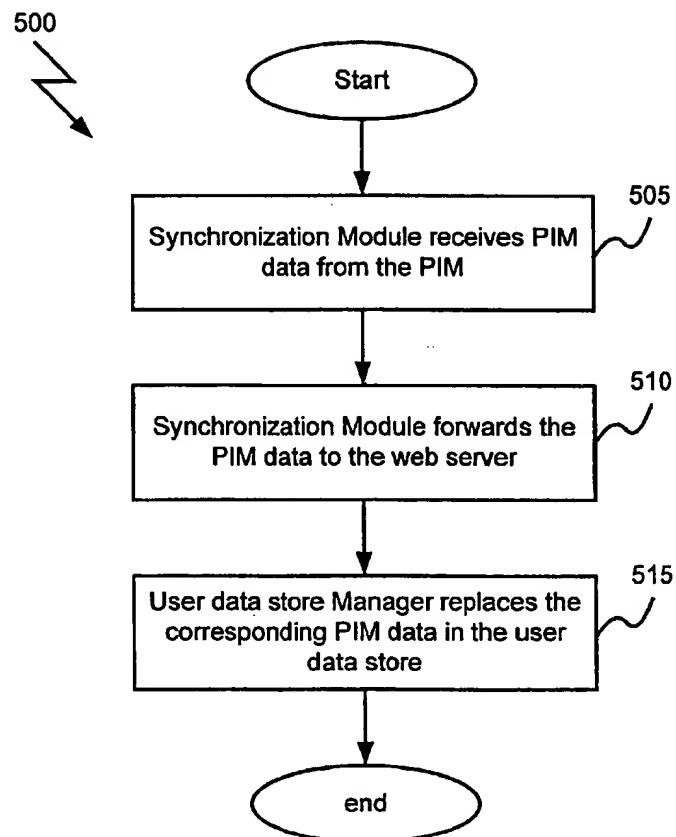


FIG. 5 (Replace)

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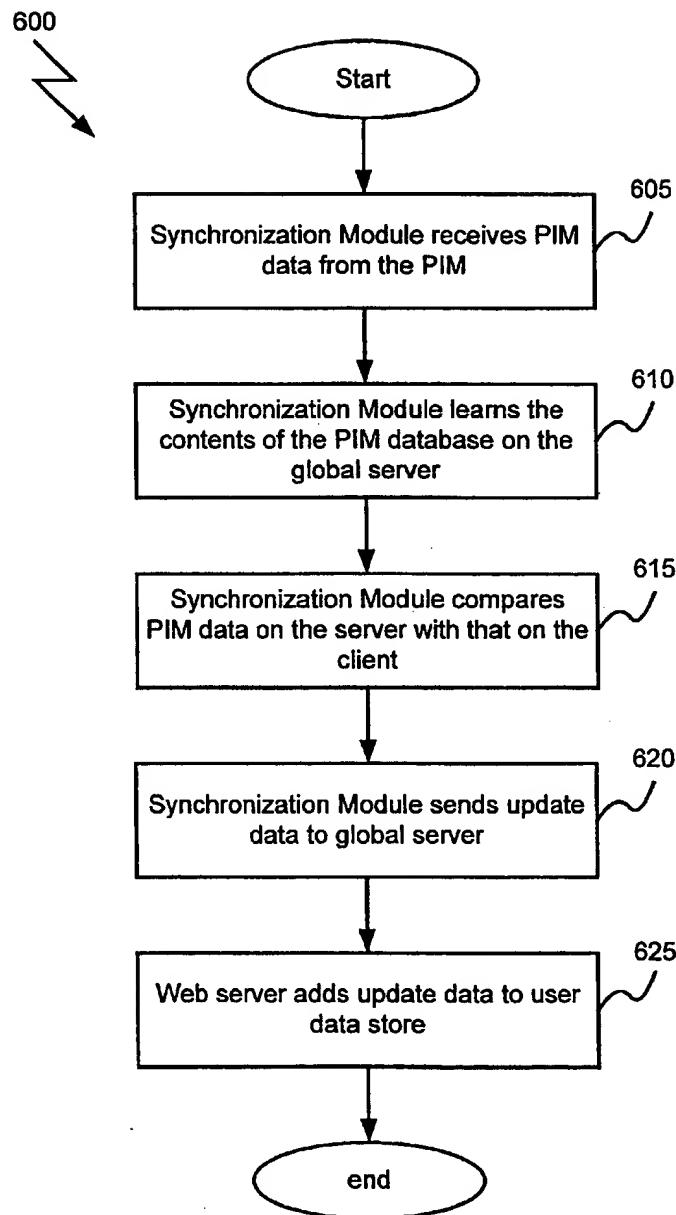


FIG. 6 (Merge)

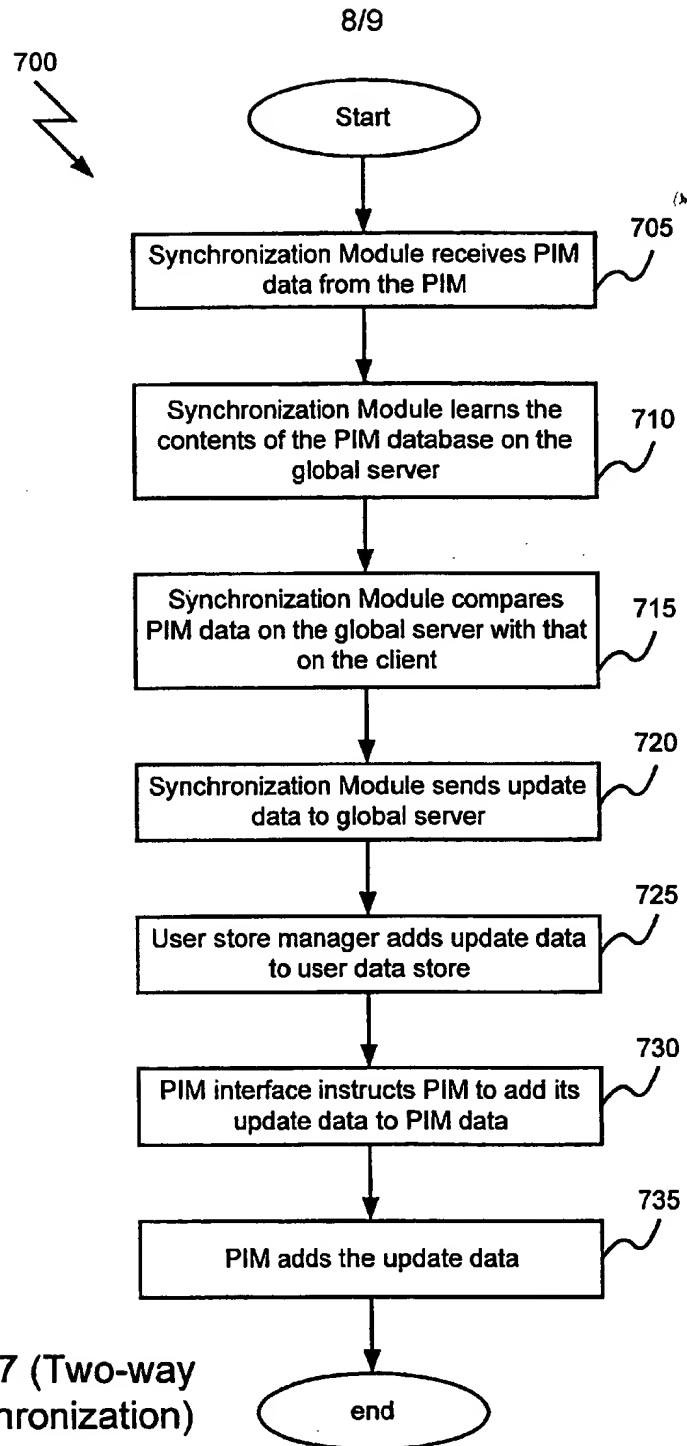


FIG. 7 (Two-way synchronization)

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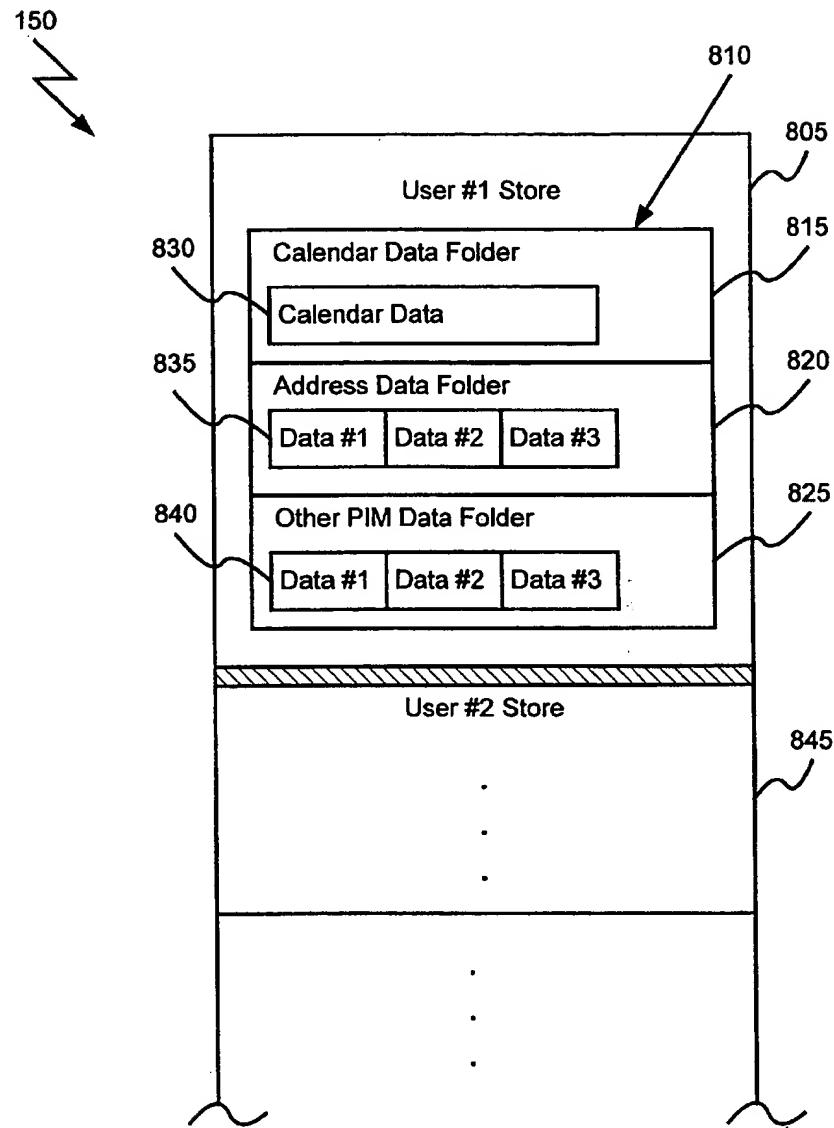


FIG. 8

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US99/21723

<b>A. CLASSIFICATION OF SUBJECT MATTER</b> IPC(6) :G06F 17/30 US CL :707/10,1,3,200,203; 395/200.33 According to International Patent Classification (IPC) or to both national classification and IPC		
<b>B. FIELDS SEARCHED</b> Minimum documentation searched (classification system followed by classification symbols) U.S. : 707/10,1,3,200,203; 395/200.33		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) WEST 1.2		
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y,E	US 5,966,714 A (HUANG et al) 12 October 1999, abstract, figures 1C, 3H and 5D, col.2 lines 16-31	1-49
Y	US 5,729,735 A (MEYERING) 17 March 1998, abstract, figures 1 and 2, col.4 line 54 through col.5 line 58	1-49
Y	US 5,710,918 A (LEGARDE et al) 20 January 1998, abstract, figure 7, col.11 lines 40-60	1-49
Y,P	US 5,862,325 A (REED et al) 19 January 1999, figure 1, col.4 line 44 through col.5 line 56, col.8 line 5 through col.10 line 10	1-49
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family ann ... .		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed		
Date of the actual completion of the international search  22 NOVEMBER 1999	Date of mailing of the international search report  03 FEB 2000	
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